Remarks:

Reconsideration of the application is requested.

Claims 1 and 3-11 are now in the application. Claim 1 has been amended. Claim 2 has been cancelled.

In deference to the requirement in the section entitled "Specification" on page 2 of the above-identified Office action, the specification has been amended to more clearly define the charge q_c.

The relationship between critical charge and critical field strength is also expressed by Poisson's equation as mentioned by the Examiner. This equation connects the electrical field strength E with the charge density so that in a predetermined volume region, by Poisson's equation, the charge contained in that region is clearly connected with the field strength effected by the charge. A critical field strength can thus be assigned to a critical charge and vice versa.

In the section entitled "Claim Rejection - 35 USC § 112" on pages 2-3 of the above-identified Office action, claim 2 has been rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

More specifically, the Examiner has stated that in claim 2 the critical charge density is not linked to an electric field applied between the first and second electrodes by Maxwell's equation (Poisson's equation) unless a charge distribution is provided as well. Claim 2 has been amended to link the charge quantity q to the electric field strength between the first and second electrodes by the equation $\int_0^W \rho(z)dz = q$ and Poisson's equation $\nabla E = -4\pi\rho$.

It is accordingly believed that the claims meet the requirements of 35 U.S.C. § 112, first paragraph. Should the Examiner find any further objectionable items, counsel would appreciate a telephone call during which the matter may be resolved. The above-noted changes to the claims are provided solely for cosmetic and/or clarificatory reasons. The changes are neither provided for overcoming the prior art nor do they narrow the scope of the claims for any reason related to the statutory requirements for a patent.

In the section entitled "Claim Rejection - 35 USC § 102" on pages 3-5 of the above-mentioned Office action, claim 1 has been rejected as being anticipated by Laska et al. ("A 2000 V-

Non-Punch-Through-IGBT with Dynamical Properties like a 1000 V-IGBT", Int. Electron Dev. Mtg., New York, 1990 IEEE, pp.807-810) under 35 U.S.C. § 102(b).

The Laska et al. reference was written for the predecessor in interest of the corporate assignee of the instant application and Applicants are therefore very familiar with this reference.

The rejection has been noted and claim 1 has been amended in an effort to even more clearly define the invention of the instant application. More specifically, the feature of claim 2 has been added to claim 1.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 1 calls for, inter alia:

> a specific charge density ρ(z) in a direction z between said pn junction and said second main surface such that:
> $\int_0^W \rho(z)dz \leq 0.9q_c$.

Laska et al. pertain to a relationship between electrical punch-through and expansion of the space charge region in vertically constructed power semiconductor components. For example, a wafer thickness of 300 µm is recommended at a critical expansion of the space charge region of 310 µm in order to achieve a volume breakdown voltage which is as high as possible (see the third paragraph on page 807, right-hand column, in combination with Fig. 1).

However, the adjustment of the specific charge density in the semiconductor to values below 90% of the critical charge density is not discussed in Laska et al.

Clearly, Laska et al. do not show "a specific charge density ρ(z) in a direction z between said pn junction and said second main surface such that: $\int_0^W \rho(z)dz \leq 0.9q_c$", as recited in claim 1 of the instant application.

Claim 1 is, therefore, believed to be patentable over Laska et al.

In item 4 on pages 5-6 of the above-mentioned Office action, claim 3 has been rejected as being unpatentable over Laska et al. in view of Hutchings et al. (US Pat. No. 5,387,528) under 35 U.S.C. § 103(a).

Hutchings et al. do not describe anything that goes beyond a field-effect transistor where a highly-doped connection region 4a is present (see Fig. 1 and col. 6, lines 13 to 19).

Clearly, Hutchings et al. also do not show "a specific charge density $\rho(z)$ in a direction z between said pn junction and said second main surface such that: $\int_0^W \rho(z)dz \leq 0.9q_c$", as recited in claim 1 of the instant application.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1. Claim 1 is, therefore, believed to be patentable over the art and since claim 3 is dependent on claim 1, it is believed to be patentable as well.

In item 5 on pages 6-9 of the above-mentioned Office action, claims 1 and 3-5 have been rejected as being unpatentable over Park (US Pat. No. 5,702,961) in view of Laska et al. under 35 U.S.C. § 103(a).

Park discloses a method for producing IGBTs having, at their cathode sides, n^+ and p^+-conductive regions 102, 104, which can be compared with the regions (9, 10) of the invention of the instant application. However, Park does not show "a specific charge density $\rho(z)$ in a direction z between said pn junction and said second main surface such that: $\int_0^W \rho(z)dz \leq 0.9q_c$", as recited in claim 1 of the instant application.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1. Claim 1 is, therefore, believed to be patentable over the art and since claims 3-5 are ultimately dependent on claim 1, they are believed to be patentable as well.

In item 6 on page 9 of the above-mentioned Office action, claim 6 has been rejected as being unpatentable over Park and Laska et al. in view of Fruth et al. (US Pat. No. 6,011,280), or, in the alternative, as being unpatentable over Laska et al. in view of Fruth et al. under 35 U.S.C. § 103(a).

As discussed above, claim 1 is believed to be patentable over the art. Since claim 6 is dependent on claim 1, it is believed to be patentable as well.

In item 7 on pages 9-10 of the above-mentioned Office action, claims 8-10 have been rejected as being unpatentable over Park and Laska et al. and further in view of Yamaguchi et al. (US Pat. No. 5,821,586) or, in the alternative, as being unpatentable over Laska et al. in view of Yamaguchi et al. under 35 U.S.C. § 103(a).

Yamaguchi shows n^+ and p^+-conductive regions 4, 5 (see Fig. 4). However, these regions cannot be interpreted as compensation regions which are to be compared with the region 24 of the exemplary embodiment of Fig. 4 of the instant application.

Claims 8-10 are believed to be patentable for the reason discussed above as well as because they are ultimately dependent on claim 1.

In item 8 on pages 10-11 of the above-mentioned Office action, claim 11 has been rejected as being unpatentable over Park and Laska et al. and further in view of Yamamoto (Japanese Patent Application JP 404234173A) or, in the alternative, as being unpatentable over Laska et al. in view of Yamamoto under 35 U.S.C. § 103(a).

As discussed above, claim 1 is believed to be patentable over the art. Since claim 11 is dependent on claim 1, it is believed to be patentable as well.

Applicants acknowledge the Examiner's statement in item 9 on page 11 of the above-mentioned Office action that claim 7 would be allowable if written in independent form including all of the limitations of the base claim and any intervening claims.

Since claim 1 is believed to be patentable as discussed above and claim 7 is ultimately dependent on claim 1, it is believed to be patentable in dependent form. A rewrite is therefore believed to be unnecessary at this time.

In view of the foregoing, reconsideration and allowance of claims 1 and 3-11 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate a telephone call so that, if possible, patentable language can be worked out.

Please charge any fees which might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

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REG. NO. 29,308

For Applicants

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September 6, 2002

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Applic. No.: 09/838,743

Marked-Up Version of the Amended Paragraphs in the Specification and Marked-Up Version of the Amended Claims:

The paragraph starting on page 14, line 17 and ending on page 15, line 4 now reads:

In accordance with an added feature of the invention, the layer thickness of the semiconductor body has a specific charge density ρ in a direction z between the pn junction and the second main surface such that:

$$\int_0^W \rho(z)dz \leq 0.9q_c$$

in which [W denotes the layer thickness, and] q_c denotes a critical value of the charge quantity q in the semiconductor body [and is] at which the electrical breakdown is reached, said change quantity q being linked to an electric field strength E [applied] between the first electrode and the second electrode by [Maxwell] the above equation[:]

$\int_0^W \rho(z)dz = q$ and Poisson's equation $\nabla E = -4\pi\rho$ [$\vec{\nabla}.\vec{E} = -4\pi\rho$].

Claim 1(amended). A vertically structured power semiconductor component, comprising:

a semiconductor body of a first conductivity type and having a first main surface and a second main surface opposite said first main surface;

a body zone of a second conductivity type opposite of said first conductivity type introduced into said first main surface;

a zone of said first conductivity type disposed in said body zone;

a first electrode making contact with said zone and with said body zone;

a second electrode disposed on said second main surface;

an insulating layer disposed on said first main surface;

a gate electrode disposed above said body zone and separated from said body zone by said insulating layer; and

an intersection of said semiconductor body and said body zone defining a pn junction[,];

said semiconductor body having:

a layer thickness between said pn junction and said second main surface selected such that, when one of a maximum allowed blocking voltage and a voltage just less than this, is applied between said first electrode and said second electrode, a space charge zone created in said semiconductor body meets said second main surface before a field strength E created by an applied blocking voltage reaches a critical value E_c at which an electrical breakdown is reached; and

a specific charge density ρ(z) in a direction z between said pn junction and said second main surface such that:

$$\int_0^W \rho(z)dz \leq 0.9q_c$$

in which [W denotes the layer thickness, and] q_c denotes a critical value of the charge quantity q in said semiconductor body [and is] at which the electrical breakdown is reached, said change quantity q being linked to [an] said electric field strength E [applied] between said first electrode and said second electrode by [Maxwell] the above equation[:]

$\int_0^W \rho(z)dz = q$ and Poisson's equation $\nabla E = -4\pi\rho$ [$\vec{\nabla}.\vec{E} = -4\pi\rho$].